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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF SECRETARY

January 25, 1995

Office of the Secretary
Federal Communications Commission
Washington, D.C. 20554

Reference: **ET Docket No. 94-124, RM-8308**, Amendments of Parts 2 and 15 of the Commission's Rules to Permit Use of Radio Frequencies Above 40 GHz for New Radio Applications.
NOTICE OF PROPOSED RULEMAKING Released: November 8, 1994

Dear Sir or Madam,

In response to the referenced Notice of Proposed Rulemaking, ET Docket No. 94-124, the attached comments are hereby submitted from VORAD Safety Systems, Inc. An original plus nine copies are provided in accordance with Sections 1.415 and 1.419 of the Commission's Rules, 47 CFR, for distribution to the Commissioners, Secretary, Bureau and the Information Office.

The FCC is to be commended for its forward thinking on this proposed rule making in that this action will open up frequency spectrum for very important new applications. Of special interest to VORAD Safety Systems, Inc., the vehicle radar spectrum proposed will lead to significant human safety improvements in the areas of vehicle collision and accident avoidance as well as other Intelligent Vehicle Highway Systems applications.

VORAD Safety Systems, Inc. stands ready to cooperate with and assist the FCC in this important rule making action in any manner desired by the FCC.

Sincerely,

Daniel F. Malloy

Daniel F. Malloy
President

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Comments Due January 30, 1995

Comments By
VORAD Safety Systems, Inc.

Specific Comments on the Proposed Rule Making:

1) Page 3, paragraph 6.

The AAMA requested frequency of 24.75-25.25 GHz was incorrect. Presumably the AAMA meant to list the frequency that VORAD Safety Systems is currently using under FCC waiver for the VORAD production radar systems which is 24.725 GHz \pm 50 MHz (24.675-24.775 GHz). Although VORAD previously indicated that production hardware in the 46-50 GHz band could be designed and produced faster and at lower cost than the higher millimeter wave frequencies, in view of the timing on this rule making action, it is requested that the 24.675-24.775 GHz frequency band be included in this proposed rule making for vehicle radar use so that current and planned production can continue.

2) Page 8, paragraph 16.

Although the current VORAD radar system design could share spectrum with other general users, VORAD supports the recommended FCC position that vehicle radar systems should operate on an unlicensed basis, that for reasons of safety, vehicle radar systems should have exclusive use of the assigned bands and that the provisions covering vehicle radar systems should be under Part 15 of the rules.

3) Page 9, paragraph 20.

The first sentence of this paragraph proposes "to designate all of the 40.5-42.5 GHz and virtually all of the 47.2-48.2 band for licensed use (except for a small portion that would be designated for vehicle radar use, as indicated below)." This exception refers to the VORAD requested vehicle radar band at 47.2-47.4 GHz. The third sentence proposes to "provide spectrum for licensed services in each of the following bands: 40.5-42.5 GHz, 47.4-48.2 GHz, . . .". Thus, the first sentence appears to include the vehicle radar band of 47.2-48.2 GHz (with an exception note) in the licensed use spectrum and the third sentence excludes the 47.2-47.4 GHz band. Since this could cause confusion to the reader, it is recommended that the first sentence exclude any reference the 47.2-47.4 GHz vehicle radar band for licensed users.

4) Page 14, paragraph 30.

As mentioned in the above comment 1), the frequency band of 24.75-25.25 GHz of the AAMA request was incorrect. The correct frequency band is 24.675-24.775 GHz as stated in the waiver. It is requested that this frequency band be included in the vehicle radar assigned bands of this rule making. This band is only 100 MHz wide and VORAD production use of this frequency band for its current production vehicle radar systems, since September 1993, has surfaced no interference problems with aviation radionavigation systems.

5) Page 15, paragraph 31.

The vehicle radar bands should definitely be exclusively for unlicensed vehicle radar use and should not be shared with other uses. The vehicle radar systems will be used for collision warning, automatic cruise control, automatic braking plus other longitudinal and lateral vehicle control applications. False alarms caused by potential emissions by shared users must be minimized to get the highest safety payback. Vehicle radar manufacturers can develop interference avoidance systems to cope with other vehicle radar systems on the road, but if the band is shared with unlimited emitters and users, it will be much more difficult, and therefore more costly, to design interference avoidance schemes for all possibilities. Broad beam general purpose systems would create more potential interference problems than narrow beam vehicle radar systems.

6) Page 16, paragraph 34.

VORAD supports the FCC proposal to require compliance over a temperature range of -20 to +50 degrees Celsius and that this temperature range should apply to both licensed and unlicensed equipment.

In the past, the FCC has not tried in general to specify susceptibility standards and VORAD recommends that the FCC should not commence specifying general susceptibility standards for equipment now. Susceptibility standards must be determined by the application and the effects caused. Equipment must be designed to be sufficiently resistant to susceptibility to meet the operational requirements in the worst case EMI environment.

7) Page 16, paragraph 36.

VORAD supports the FCC proposal that measurements for type acceptance purposes be in accordance with good engineering practice.

8) Page 17, paragraph 40.

VORAD supports the FCC proposed power limit of 30 microwatts/cm² at 3 meters. VORAD experience has shown that effective vehicle radar systems can be produced with power levels within this proposed limit. VORAD has observed a great concern by the public over the radiation safety issues of production radar systems. The FCC should keep the power limit as low as possible consistent with adequate radar performance in order to provide as much margin as possible for human safety issues. VORAD also supports compliance with the IEEE C95.1-1991 standard.

The approach of allowing higher power for equipment with special design features or safety interlocks to preclude human exposure is not recommended for vehicle radar systems. It is difficult to design in human safety devices or mechanisms that will not fail or cannot be defeated plus these systems can occasionally

expose maintenance personnel to radiation hazards during equipment repairs when the safety features may be inactivated. The safest approach is for radar radiation to be at safe levels at all times without the need for special safety features.

9) Page 18, paragraph 41.

The spurious emission limitation of 2 picowatts/cm² measured 3 meters from the radiating surface will be very difficult to meet for the vehicle radar equipment. If a vehicle radar system is transmitting at the proposed limit of 30 microwatts/cm², this spurious emission limit would require harmonics and spurious emissions to be down 72 dB from the fundamental operating frequency. This would impose severe and costly design features and in many cases may not be physically realizable. It is recommended that the spurious and harmonic emission limits remain at the present Part 15 regulation levels which require harmonics to be down 40 dB or more from the fundamental and requires spurious emissions to be down 50 dB or more from the fundamental.

The proposed method of specifying frequency stability is supported by VORAD. The requirement that equipment performance remain in band over the temperature range of -20 to +50 degrees Celsius and over a voltage range of 85% to 115% of rated voltage is a good standard and one that is familiar to the industry. Frequency tolerance specifications in parts-per-million is not recommended.

10) Page 19, paragraph 42.

VORAD supports the position that the industry should develop voluntary standards to address potential susceptibility problems. This would be a difficult standard for the FCC to develop in view of the unlimited number of existing and potential equipment applications and the numerous variations in EMI environments that can be encountered.

11) Page 19, paragraph 44.

VORAD does not support the need for more specific guidance for measurements performed on devices operating above 40 GHz. The existing measurement procedures are adequate.

12) Page 20, paragraph 45.

The proposed requirement that all Part 15 transmitters operating between 10 GHz and 30 GHz be measured to the fifth harmonic or to 100 GHz, whichever is lower, will create great difficulties for existing and planned production equipment. VORAD recommends that the limits of Part 15.245 remain unchanged for harmonics and spurious emissions that fall in the 40 GHz to 100 GHz region. Specifically, for equipment operating at 24.125 GHz, the harmonic limit should remain at 25 millivolts/meter measured 3 meters from the radiating surface as specified in Part 15.245(b) and spurious emissions limit should remain at 50 dB below the fundamental per Part 15.245(b)(3). Existing equipment and existing production designs for equipment operating between 10 GHz and 30 GHz should be allowed to continue under the existing harmonic and spurious emission standards.

13) Page 21, paragraph 47.

The limit on peak power density of 30 microwatts/cm² at 3 meters from the radiating surface is quite sufficient and is considerably more than required for VORAD type radar systems.

However, the proposed peak power density limit outside the main lobe of 200 nanowatts/cm² is overly restrictive and very difficult if not impossible to achieve for some types of antennas. For the proposed peak power limit of 30 microwatts/cm² in the main lobe, all side lobes would have to be down 22 dB or more from the main lobe in order to meet the 200 nanowatts/cm² limitation. In many antenna designs, the side lobes nearest the main lobe may be down only 15 dB from the main lobe while the side lobes further out from the main lobe are dropping in magnitude to as low as 40 dB below the main lobe.

Many of the planned vehicle radar applications require angular data on targets. This can be obtained by several methods including mechanical or electrical scanning of the antenna over some small angular sector in front of the vehicle, or beam switching to periodically scan a small angular sector. In these cases, the scanning main lobe will periodically place the peak power density in all angles of the scanned sector. This will have a much greater impact on energy outside the main lobe of a fixed beam antenna than the effect of side lobe levels.

In addition, for low-gain, wide coverage antennas such as those used in side-looking, lane-changing sensors, or backup sensors, the side lobes levels are of lesser importance. These types of sensors may require hemispherical coverage and side lobe specifications could prohibit such applications.

The FCC has not specified side lobe limitations in the past and VORAD recommends that the FCC continue that approach for vehicular radar systems operating over 40 GHz. This is a very difficult standard to define because of the great variation in antenna beam patterns. It is inconsistent to specify the peak power limit outside the main lobe with no consideration for the beamwidth of the main lobe. If the FCC determines that peak power density limits are required outside the main lobe or that the shape of the antenna beam patterns need to be limited, VORAD suggests that some sort of tapered profile be used that allows higher side lobes near boresight and lower side lobe levels as the angle from boresight increases. The first side lobe should be allowed to be as high 15 dB down from the main lobe with subsequent side lobes dropping with angular displacement from boresight.

14) Page B-5, Section 15.33(a)(2).

As discussed in VORAD comment 12 above, VORAD is concerned that the existing Part 15 standard for the limitation on harmonics remain at the present 25 millivolts/meter at 3 meters for equipment operating at 24.125 GHz (and the VORAD 24.725 GHz equipment).

15) Page B-6, Section 15.253(c)(1).

The proposed standard of "30 microwatts/cm² at 3 meters when the vehicle is moving at a minimum rate of one Kilometer/hour" is not understood. Does this mean that all vehicle radar systems require an interface to the speedometer and some type of a switch that is activated at one kilometer/hour? This would be expensive and would rely on the accuracy/performance of the speedometer. VORAD strongly recommends that the reference to vehicle speed be deleted from the peak power density limitation.

16) Page B-6, Section 15.253(c)(2).

The limitation of 2 picowatts/cm² at 3 meters for power density of emissions outside the specified band cannot be readily achieved with current low cost technology as discussed in the VORAD Comment 9 above. VORAD recommends that the existing Part 15 standards also be applied to equipment operating above 40 GHz. This standard should be to limit harmonic emissions to 40 dB or more below the fundamental frequency peak power density and to limit spurious emissions to 50 dB or more below the

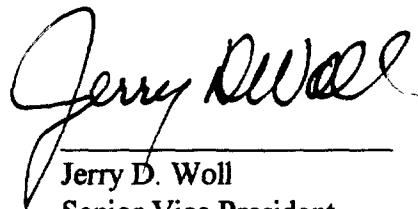
fundamental frequency. This existing standard has been effective in controlling out-of-band emissions for equipment operating under 40 GHz and should be just as effective for bands above 40 GHz.

General Comment:

The existing FCC Part 15 regulation for frequencies under 40 GHz limits maximum field strength for intentional radiators to specified voltage limits in volts per meter at a distance of 3 meters from the radiating surface. This new rule making proposal for frequencies above 40 GHz specifies peak power limits in watts per square meter at 3 meters from the radiating surface to limit field strength. The reasoning for using different units of measure for above and below 40 GHz is not understood. It is recommended that the same units be used for field strength limits for all frequency bands. The industry has become familiar with the FCC volts/meter measurements so it is recommended that those units also be used in this proposed rule making.

January 25, 1995

Date

A handwritten signature in black ink, reading "Jerry D. Woll". The signature is fluid and cursive, with a horizontal line drawn underneath the name.

Jerry D. Woll

Senior Vice President.

Engineering & Product Development

VORAD Safety Systems, Inc.